Bauer

AM BROADCAST TRANSMITTER
MODEL 720

INSTRUCTION BOOK

Bauer

ELECTRONICS CORPORATION

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Bauer Electronics Corporation
1663 Industrial Road
San Carlos, California

BAUER ELECTRONICS CORPORATION

INSTALLATION AND OPERATING INSTRUCTIONS
AM BROADCAST TRANSMITTER
MODEL 720

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WARRANTY

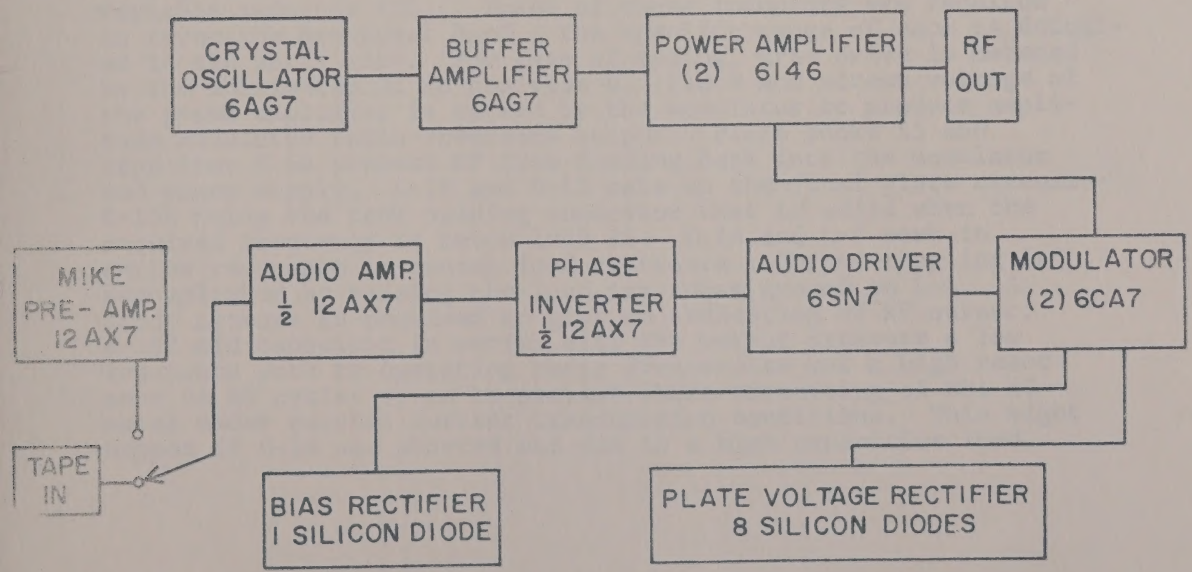
Bauer Electronics Corporation warrants new equipment of its manufacture and assembly for one (1) year against breakage or failure of parts due to imperfection of workmanship or material, its obligation being limited to repair or replacement of defective parts upon return thereof, prepaid to the Bauer plant. High-voltage transformers, modulation transformers and reactors and filter chokes carry an extended warranty with 50% of the replacement cost being allowed should failure occur during the second year. Warranty will be based on date of invoice. No return shipments will be accepted without prior authorization. Electron tubes and silicon rectifiers bear only the warranty of the manufacturer thereof in effect at the time of shipment to Purchaser.

WARRANTY

SUMMARY OF MECHANICAL AND ELECTRICAL SPECIFICATIONS

Type of emission	A3	Noise level (below 100% mod.)	-50db
Rated power output	50 watts	Efficiency factor (F)	0.65%
RF Output Impedance adjustable over wide range		Power consumption (50 watts out) 100% modulation	265 watts
		Power requirements	110 volts 50/60 cycles 90% power factor
Frequency range 540-1600 kc			
Frequency stability	±5cps	Dimensions	Height 10½" Width 19 " Depth 17 "
Audio input level			
Mike input	-50dbm		
Tape input	0dbm		
Audio input impedance	Hi	Ambient temperature range	-20 to +110 F
Frequency response (0-95% Mod) 50-7500 cps	±2db	Altitude range	0-8000 feet
Distortion (0-85% Mod)	5% max	Carrier shift	Less than 5%

FUNCTIONAL BLOCK DIAGRAM



DESCRIPTION OF CIRCUIT FUNCTIONS

The Bauer Model 720 AM Broadcast Transmitter employs high-level modulation and can operate on any carrier frequency in the range from 540 to 1600 KC. With modifications, operation can be extended to 30 MC. The transmitter is normally supplied pre-tuned to the desired channel. The Model 720 is capable of a 50 watt output into a matched load. Though the unit was originally designed as a carrier current transmitter (using the AC mains as the antenna) it can also be used as a test site transmitter for conductivity measurements and in any other broadcast service where low power is practical. The output coupling system is designed to match a wide range of impedances so that the installation can be made without the use of extensive test equipment normally needed in antenna matching.

RADIO FREQUENCY SECTION

The radio frequency portion of this transmitter begins with Type 6AG7 crystal oscillator (V1). The crystal (XL1) is of the vacuum type, capable of a plus or minus 5 cycle stability without ovens. A small variable capacitor mounted on the oscillator-buffer sub-assembly (C1) allows a minor adjustment of frequency. The oscillator is a stable electron coupled unit and drives a second 6AG7 buffer amplifier, V2. The oscillator and buffer are mounted on a compact turret assembly. The buffer output excites the two final Type 6146 tubes (V3 and V4) operated in parallel. Tuning of the final grid is accomplished by adjusting the variable inductor (L4). Three of these inductors are required to cover the broadcast band - the specific range of each is detailed in the parts list. For ease of tuning, grid drive is metered by the multimeter M1 in position 4. Plate and screen voltage of the power amplifier is varied by the modulator to produce amplitude modulated radio-frequency output. Plate choke L5 and capacitor C-14 prevent RF from feeding back into the modulator and power supply. L-16 and C-15 make up the final plate circuit - C-15A being the tank padding capacitor that is added when the required frequency is below 1000 KC. C-16 and L-7 work in series resonance to cancel load reactance. Output coupling is accomplished by raising the load tap above ground on L-6. A diode network is provided to give an indication of RF output. A .02 mfd capacitor in series with the output presents a low reactance path to operating radio frequencies but a high reactance to 60 cycles so as to prevent short circuiting of the AC mains under carrier current transmission conditions. This might happen if C-16 was shorted out due to a high capacitive load.

AUDIO SECTION

The audio portion of the Model 720 transmitter starts with the microphone pre-amplifier, a Type 12AX7 (V5). This stage is incorporated into a plug-in unit for space conservation and RF shielding. The pre-amp output and the hi-level tape input are selectable by S3 and feed ½ of a 12AX7 voltage amplifier (V6A). The grid of this tube is grounded through R55 when the mike-tape selector switch is in the center (off) position. Both the mike level control (R28) and the tape level control (R54) are located on the front panel. Following V6A is a phase inverter, ½ of a 12AX7 (V6B). This stage provides equal audio signals of opposite phase to the audio driver tube Type 6SL7 (V7A/B). A potentiometer (R50) in the cathode of this stage provides an adjustment to minimize distortion. This control is labeled DIST and is located on the front panel below M1. The modulators are Type EL34/6CA7 tube (V8, V9) operated push-pull Class AB-1. A balance control (R-42) in the cathode of this stage provides a means of equalizing modulator plate currents. This control, labeled MOD, is located on the front panel below M1. Inverse feedback around the last four audio stages is provided by a voltage divider connected between the modulation transformer secondary and the cathode of V6A. A RC network of R51 and C22 establish the amount of audio feedback at 7DB. The audio output voltage appearing across the secondary of modulation transformer T2 produces amplitude modulation by alternately adding to and subtracting from the DC voltage applied to the final RF power amplifier.

POWER SUPPLY

A single plate transformer (T1), a bias transformer (T3) and two filament transformers (T4/T5) supply all of the voltages necessary for the operation of the Model 720 transmitter. A total of eight silicon diodes in a full wave bridge rectifier system provides a final plate voltage of approximately 500 volts. Use of the HV transformer center tap provides an efficient manner of supplying a lower voltage for the intermediate stages. A neon indicator (I1) located above M1 indicates the presence of plate voltage.

A single silicon diode (D9) in a simple half wave rectifier circuit provides the bias voltage for the modulator tubes. The bias is adjusted by varying R-19 located on the top of the chassis between V8 and V9.

Two 6.3 VAC filament transformers (T4 and T5) supply filament voltages to all stages except the microphone pre-amplifier V5A/B - this tube gets its filament power from a winding on the bias transformer (T3).

The primaries of all transformers are fused by a 5 ampere 3AG Slo-Blo fuse housed in a indicating type holder.

Switch S1 controls filament power while Switch S2 in the primary of the HV transformer (T1) controls plate power.

METERING CIRCUIT

A multi-meter (M1) provides metering of final grid current, final plate and screen current, both modulator tube currents and a relative indication of power output. With the exception of the latter, the meter is a direct reading instrument when the multiplication factors indicated on the front panel are used. In normal operation it is suggested that the meter be left in either Mod 1 or Mod 2 position so that the audio level can be properly monitored.

MONITORS

A provision is made for the connection of a frequency monitor using a BMC connector on the rear of the chassis marked "Freq.". If it is necessary to feed a modulation monitor this can be accomplished by making up a coil consisting of three or four turns of #16 wire and slipping it over the plate tank coil, L6.

INSTALLATION INSTRUCTIONS

ENVIRONMENT

The Bauer Model 720 AM Broadcast Transmitter is designed for rack mounting and should be installed so as to permit a smooth passage of air past the unit. If used on a table top the transmitter should be raised at least one inch to allow air to enter through the bottom plate.

UNPACKING

The transmitter is shipped with all components, tubes and crystal mounted in place. Check to be certain that the tubes are firmly in their sockets. Note that the oscillator, buffer and crystal are mounted underneath the chassis. Until testing is completed it is recommended that the unit be operated on a table or bench to permit easy accessibility to the various tuning elements.

EXTERNAL CONNECTIONS

Connect the AC cord supplied to a 110 volt 50/60 cycle source.

Connect a high impedance microphone to the mike input on the front panel using the connector supplied.

Connect a tape recorder, telephone line or other high level input (ODB) to the tape input jack on the rear of the chassis. Note the schematic to determine the connections of this plug.

Prepare the RF output line but do not connect it at this time since the preliminary tuning steps require a non-loaded output. If the Model 720 is to be used for carrier current transmission, feed only a 110 volt line and make certain that the common (neutral) leg is connected to the chassis. Since this type of transmission uses the AC lines as the radiating element, it is important that consideration be given to the selection of the proper feed point. The greatest loss in such a system will occur at any transformer in the line, therefore it is important that the coverage area to be served be on the same side of the supply as the RF output connection. If an attempt to feed the high voltage side of the AC mains is to be made, the proper authorities should be contacted so that the proper capacitive isolation can be made. A coaxial cable such as RG-8/U should be used to route the RF output away from the unit. This line should be kept as short as possible compatable with the selection of the proper AC line feed point.

When the Model 720 is to be used to feed an antenna, the lead-in can be connected directly to the RF output or routed to this point with a length of RG-8/U if this would be more convenient.

INITIAL ADJUSTMENTS AND TUNING

If a frequency was specified at the time your Model 720 transmitter was ordered your unit has been factory tuned and adjusted. Since the output load into which the transmitter will work in the field is rarely known, a standard 50 ohm non-reactive dummy antenna was used in the initial tests.

Before applying power, turn the modulator bias control (R19) completely CCW. R19 is located on top of the chassis. Also remove the plate caps to both 6146 tubes (V3, V4).

Turn on S1, the power on switch and note if the tube filaments are on. After approximately 30 seconds, and with the RF load disconnected, apply plate power (S2). The neon indicator above M1 should light. Switch the multimeter to the grid drive position. The meter should indicate approximately 4½ ma. if not, adjust L4, the final grid tuning coil located near V4 for a maximum indication - then adjust the drive control (R6) located on the oscillator-buffer sub-assembly for the proper grid drive. Readjustment of R6 will be necessary to maintain the proper grid drive after the plate and load have been tuned. Remove the plate voltage and replace the plate caps on V3-V4. Switch M1 to the Final I_p position and turn on the plate voltage once again. The plate current should be low (about 30 ma) (3X10 on the meter scale) provided the plate circuit is tuned to resonance and the load removed. To check this, unlock the tune dial and vary C15, the plate tuning capacitor, noting the resonance condition. Both the tune and load dials have been set so that at maximum capacity they indicate 100. Resonance should be obtained at the middle of the dial - if not, adjust the top coil clip on L5 until it does. If the dial reading is too high move the clip up, if too low, move the clip down. Be sure to turn off the plate switch when making any coil clip changes. After a proper resonance condition is obtained, place the load clip (connecting L6 to C16) three turns above ground (bottom of the coil) and connect the RF output. Turn the multi-meter to the output position. Starting with both the load dials at 100 and L7 at maximum (coil clip nearest the capacitor) vary the load control for a maximum indication on the output meter. Since the load may be either inductive or capacitive, considerable care should be taken in this adjustment. If a tunable minimum indication cannot be obtained, note whether the load dial setting is high or low. If low it would indicate that the output is capacitive and C16 will have to be reduced by removing or re-arranging the padding capacitor. If high, it would indicate that the output is inductive - therefore adjustment of L7 should produce a resonance condition. C16 and L7 should be adjusted for a series resonance condition as indicated by a tunable maximum on M1 in the output position. Bear in mind that the output meter indication is a relative one only, with the resistance values of R15 and R16 selected to produce a mid-scale reading when the transmitter is working into a 50-ohm load, thus this reading will vary with the value of the load.

After a series resonance condition is reached (the output reactance is cancelled) the transmitter can be loaded to the proper output. Adjust the tune and load controls to resonance - the load for maximum indication in the output position, the tune for minimum plate current. Raise the load tap (lower tap on L6) a turn at a time until the proper loading conditions are reached i.e. maximum output with a final plate and screen current of approximately 150 ma. This adjustment is critical and should be done a turn at a time adjusting the load and tune controls each time for proper indication. When the optimum loading condition has been obtained, the audio system should be adjusted. Turn the meter selector switch to the modulator 1 position and adjust the bias control (R19) until the meter reads 3 (30 ma). Check modulator 2 and see if it gives a similar indication. Balance the modulator currents with the MOD control on the front panel. The optimum adjustment occurs when both modulators read 3, which, when the proper multiplication factor is used (3X10) indicates that the static (unmodulated) plate current is 30 ma. If the proper test equipment is available R-50 should be adjusted for minimum distortion at 3000 cycles. This control is labeled DIST and is located on the front panel below M1. Should a distortion meter not be available, and if the factory adjustment has been disturbed, R-50 should be set at mid-range.

Your Model 720 transmitter is now ready for operation. Check your meter readings with the standard values listed elsewhere in this book.

TYPICAL TRANSMITTER PERFORMANCE DATA

BAUER MODEL 720

Meter Readings

CIRCUIT	0% Mod.*	100% Mod.*
Oscillator plate (V1)	190 V	190 V
Buffer plate (V2)	190 V	190 V
Final grid	- 82 V	- 80 V
Final plate	160 ma	154 ma
Final plate Voltage	480 V	475 V
Audio amplifier (V6A)	40 V	41 V
Phase inverter (V6B)	120 V	117 V
Audio driver (V7A)	120 V	117 V
Audio driver (V7B)	130 V	126 V
Modulator 1 (V8)	50 ma	90 ma
Modulator 2 (V9)	50 ma	90 ma
Output **	5.5	5.3

*Measured with a Simpson Model 260
**Into a matched 50 ohm load

OPERATION

Under normal operation the multi-meter M1 should be left in either the Modulator 1 or Modulator 2 position. Adjust the audio gain controls so that the audio peaks produce approximately 90 ma of current. This represents a fully modulated (100%) condition.

PARTS LIST

Symbol	Part #	Description	Manufacturer
		RESISTORS	
R1	10-100	Resistor, 56 k, ½ w, 10%	
R2	10-101	Resistor, 1 k, ½ w, 10%	
R3	10-102	Resistor, 56 k, 2 w, 10%	
R4	10-103	Resistor, 22 k, 2 w, 10%	
R5	10-104	Resistor, 4.7 k, ½ w, 10%	
R6	10-225	Potentiometer, 5 k, 4 w	Mallory C5MP
R7	10-106	Resistor, 51 ohms, ½ w, 5%	
R8	10-107	Resistor, 10 k, 2 w, 10%	
R9	10-116	Resistor, 100 ohms, 2 w, 10%	
R10	10-200	Resistor, 15 k, 2 w, 10%	
R11	10-201	Meter shunt	
R12		Same as R9	
R13		Not used	
R14	10-203	Resistor, 20 k, 20 w, ww	
R15	10-204	Resistor, 100 k, 2 w, 10%	
R16		Same as R8	
R17	10-206	Resistor, 5 k, 10 w ww	Ohmite axial
R18		Same as R8	
R19	10-207	Potentiometer, 25 k, 2 w	Ohmite CLU 2531
R20	10-208	Resistor, 22 k, 2 w, 10%	
R21	10-209	Resistor, 10 k, 2 w, 10%	
R22	10-205	Resistor, 33 k, 2 w, 10%	
R23	10-210	Resistor, ~~100~~ 47 k, ½ w, 10%	
R24		Same as R23	
R25	10-211	Resistor, ~~200~~ 47 k, ½ w, 10%	
R26	10-212	Resistor, 1.8 k, ½ w, 10%	
R27		Same as R26	
R28	10-212	Potentiometer, 500 k, 2 w	Ohmite CA 5041
R29		Same as R25	
R30		Not used	
R31		Not used	
R32	10-215	Resistor, 560 k, ½ w, 10%	
R33	10-216	Resistor, 470 ohms, ½ w, 10%	
R34	10-217	Resistor, 47 k, ½ w, 10%	
R35		Same as R35	
R36		Same as R25	
R37		Same as R25	
R38	10-218	Resistor, 3.9 k, ½ w, 10%	
R39		Same as R38	
R40	10-226	Resistor, 270 k, ½ w, 10%	
R41		Same as R40	
R42	10-219	Potentiometer, 10 k, 2 w	Ohmite CLU-1031
R43		Same as R-23	
R44		Same as R-23	
R45		Same as R-23	
R46		Same as R-23	
R47	10-220	Meter shunt	
R48		Same as R-47	
R49	10-214	Resistor, 500 ohms, 5 w	Ohmite axial
R50	10-227	Potentiometer, 5 k, 2 w	Ohmite CLU-5021
R51	10-221	Resistor, 1 meg, 2 w, 10%	
R52		Not used	
R53	10-228		

Symbol	Part #	Description	Manufacturer
R54		Same as R-28	
R55		Same as R-34	
R56		Same as R-33	
R57	10-229	Meter shunt	
R58		Not used	
R59/R66	10-156	Resistor, 100 k, 1 w, 10%	
		CAPACITORS	
C1	20[illegible]-210	Capacitor, 5-50 mmfd, 500 v	EFJ 148-4
C2	20-102	Capacitor, 500 mmfd, 500 v	Elmenco CM20D501J
C3	20-103	Capacitor, .01 mfd, 600 v	Centralab D6-103
C4		Same as C3	
C5	20-104	Capacitor, 75 mmfd, 500 v	Elmenco CM-20C750J
C6	20-107	Capacitor, .02 mfd, 160 v	Centralab DDM-203
C7		Same as C3	
C8		Not used	
C9	20-105	Capacitor, 500 mmfd, 3 kv	Centralab DD30-501
C10	20-106	Capacitor, .0022 mfd, 3 kv	Aerovox HVD-30
C11	20-200	Capacitor, .001 mfd, 2500 vdc	Sangamo A-T5210
C12		Same as C10	
C13		Not used	
C14		Same as C10	
C15	20-202	Capacitor, 19-488 mmfd	EFJ 154-3
C15A	20-203	Capacitor, 500 mmfd, 2500 vdc	Sangamo A-T5350
		Padder - use determined by frequency	
C16		Same as C15	
C16A		Same as C15A	
C17	20-204	Capacitor, 02 mfd, 200 v	Sprague 2TM-S20
C18	20-205	Capacitor, .1 mfd, 400 v	Sprague 4TM-P10
C19		Same as C18	
C20		Same as C18	
C21		Same as C18	
C22	20-128	Capacitor, .1 mfd, 1 kv	Sangamo SBB 1 E10 100 4M
C23,A,B, C,D	20-206	Capacitor, 4x20 mfd, 450 v	Mallory FP 444
C24,C24A	20-207	Capacitor, 125 mfd, 450 v	Sprague TVL 1760
C25A B	20-208	Capacitor, .20 mfd, 250 v	Sprague TVL 2515
C26		~~Not used~~ Same as C-17	
C27	20-209	Capacitor, .02 mfd, 600 v	Sangamo HK 1120
		INDUCTORS	
L1, L2	30-100	RFC- 1 mh	Miller 4652
L3	30-101	RFC, 2.5 mh	National R50
L4	30-200	Coil, final grid, adjustable	
		500-900 kc	Miller 43A103CB1
		900-1300 kc	Miller 43A474CB1
		1300-1700 kc	Miller 43A224CB1
L5	30-203	RFC, 2.5 mh	National R-300U
L6	30-204	Inductor, 42 uh	5" Illumitronic 1610 T
L7	30-204	Inductor, 81 uh	4" Illumitronic 1616 T
L8	30-206	Filter choke, 10 h, 200 ma	UTC CG-40

Symbol	Part #	Description	Manufacturer
		SWITCHES	
S1	50-101	Switch, DPDT	Jan-ST52K
S2		Same as S1	
S3	50-200	Tape-mike selector	Switchcraft 13036DL
S4	50-201	Meter selector	Centralab 2513
		METERS	
M1	60-200	Meter,0-1 madc w/0-25 scale	Triplett 420R
		TRANSFORMERS	
T1	70-200	Power transformer	UTC CG-301
T2	70-201	Modulation Transformer	UTC CVM-2
T3	70-202	Bias transformer	Triad R-54X
T4	70-203	Fil. transformer	Triad F-53X
T5		Same as T4	
		VACUUM TUBES	
V1	80-100	Type 6AG7	
V2	.. ..J.	Same as V1	
V3	80-200	Type 6146	
V4		Same as V3	
V5	80-201	Type 12AX7	
V6		Same as V5	
V7	80-202	Type 6SL7	
V8	80-101	Type E134/6CA7	
V9		Same as V8	
		DIODES	
D1-D9	90-100	Silicon diode, 600 v, 1 A	Slater SLA-17
D10	90-200	Germanium diode, 1N34	
		FUSES	
F1	100-200	Fuse, 5A, 3AG Slo-Blo	Buss
F2	100-201	Fuse, .3A 3AG Fast Blo	Buss
		PILOT LAMPS	
I1	110-200	Neon Indicator	A.M.P -Ampillume
		CRYSTALS	
XL1	120-100	Crystal, vacuum	Northern Engineering Labs. Type T-12A

Symbol	Part #	Description	Manufacturer
		RECEPTACLES AND TUBE SOCKETS	
Mike In	150-200	Microphone connector chassis mount	Amphenol 75-PC1M
Mike Conn.	150-201	Microphone connector, plug	Amphenol 75-MC1F
Tape In	150-205	Audio connector, female	Cannon XLR-3-13
RF Out	150-202	UHF connector, female	Amphenol 83-1R
RF Plug	150-206	UHF connector, male	Amphenol 83-1SP
AC Input	150-203	AC receptacle	Hubbell 7427
AC Plug	150-209	AC plug	Hubbell 7466
AC Cord	150-204	AC cord and plug	Belden 17206-S
X1-X2	150-102	Osc/buffer dual turret	Vector, 10 [illegible]0-18A3-2
Monitor	150-100	Receptacle, Freq. Monitor	Amphenol 51-102
	150-101	Plug " "	Amphenol 31-002
X3,X4, X5,X7, X8,X9	150-103	Socket, 8 pin	Amphenol 77MIP-8T
X6	150-207	Socket, 9 pin	Cinch 9XM
X5A/B	150-208	Turret assembly	Vector B-10N
		MISCELLANEOUS	
SU1, SU2	160-110	Parasitic suppressor	Ohmite P-300
	250-117	Fuse holder	Buss, HKL-X
	170-200	Knob, mike-tape gain	EFJ 116-222-2
	170-201	Knob, meter selector	EFJ 116-222-5
	170-202	Dial, tune/load	Millen 10009
	170-203	Knob, mike,tape select	Switchcraft M-1177-2
	240-200	Chassis	Bauer
	230-200	Chassis support	Bauer
	230-201	Mounting bracket/osc.	Bauer
	230-202	Mounting bracket/PS	Bauer
	220-200	Insulator, feed-thru	EFJ 135-500
	240-201	Front panel	Bauer
	170-204	Insulated coupling (tune)	EFJ 104-262
	170-205	Plate connector (V3)	National SPP-3
	170-205	Plate connector (V4)	National SPP-3
	240-202	Chassis bottom plate	Bauer
	170-206	Bearing and shaft (tune)	EFJ-116-256
	170-206	Bearing and shaft (load)	EFJ-115-256
	170-207	Dial Lock	Miller 10050

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Figure 1

TOP VIEW—MODEL 720

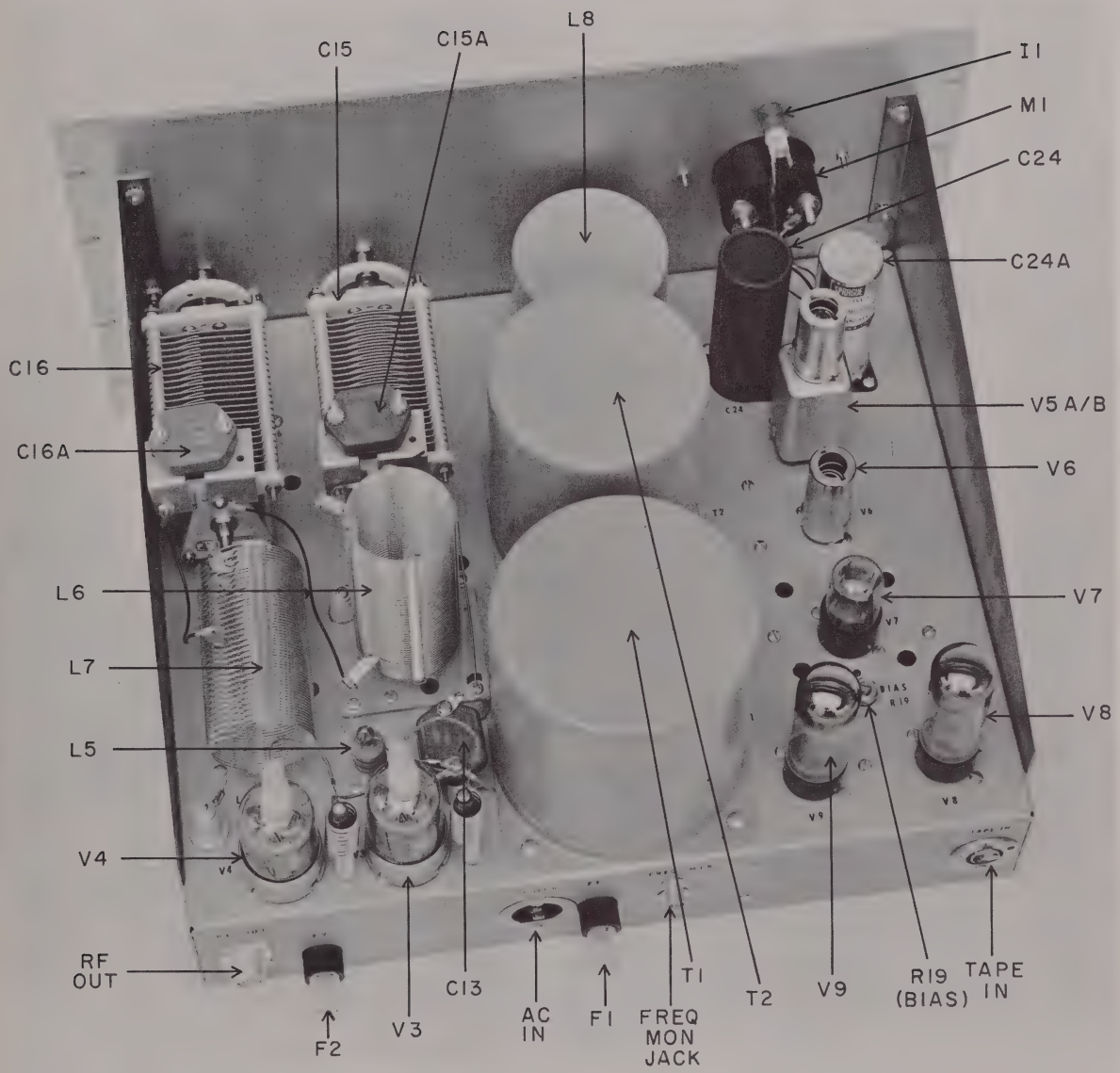

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FIGURE 2

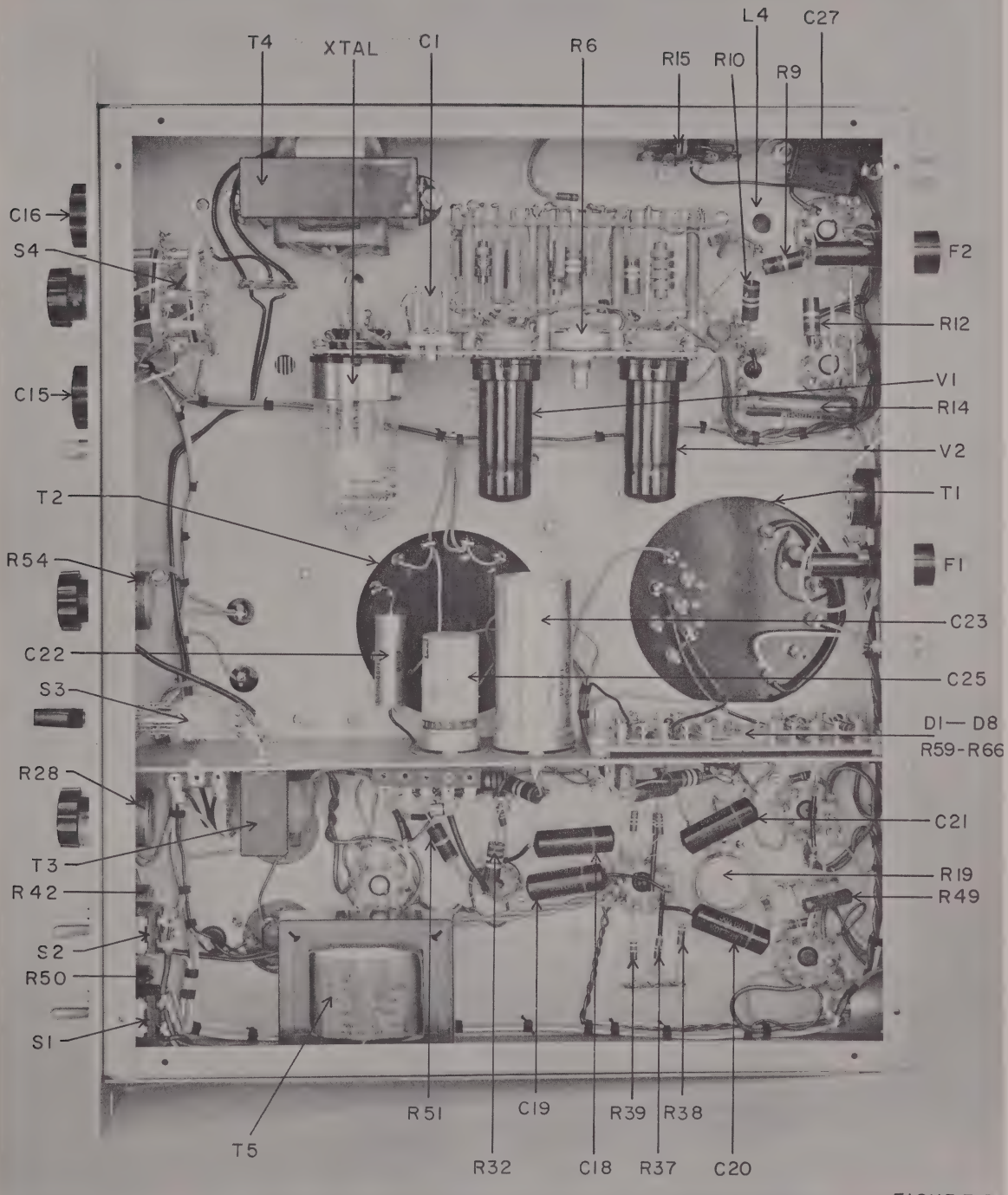

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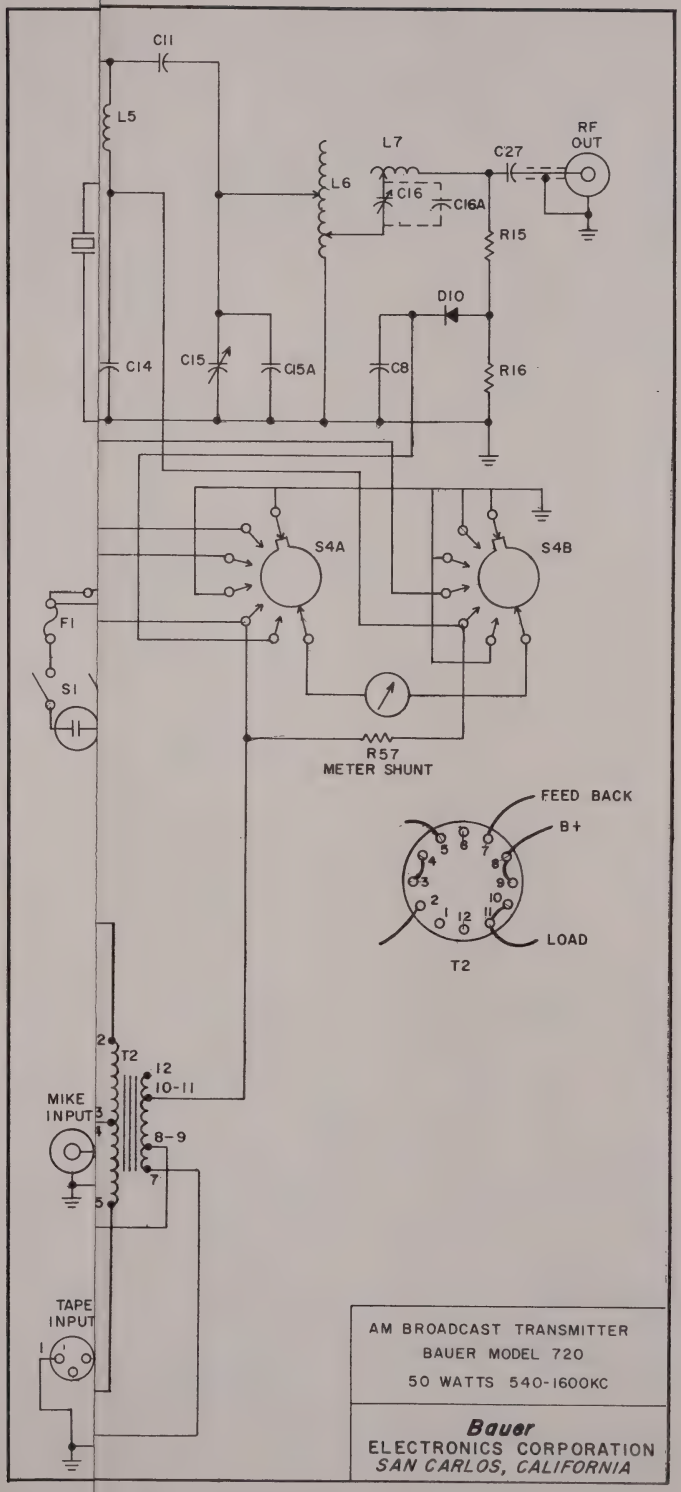
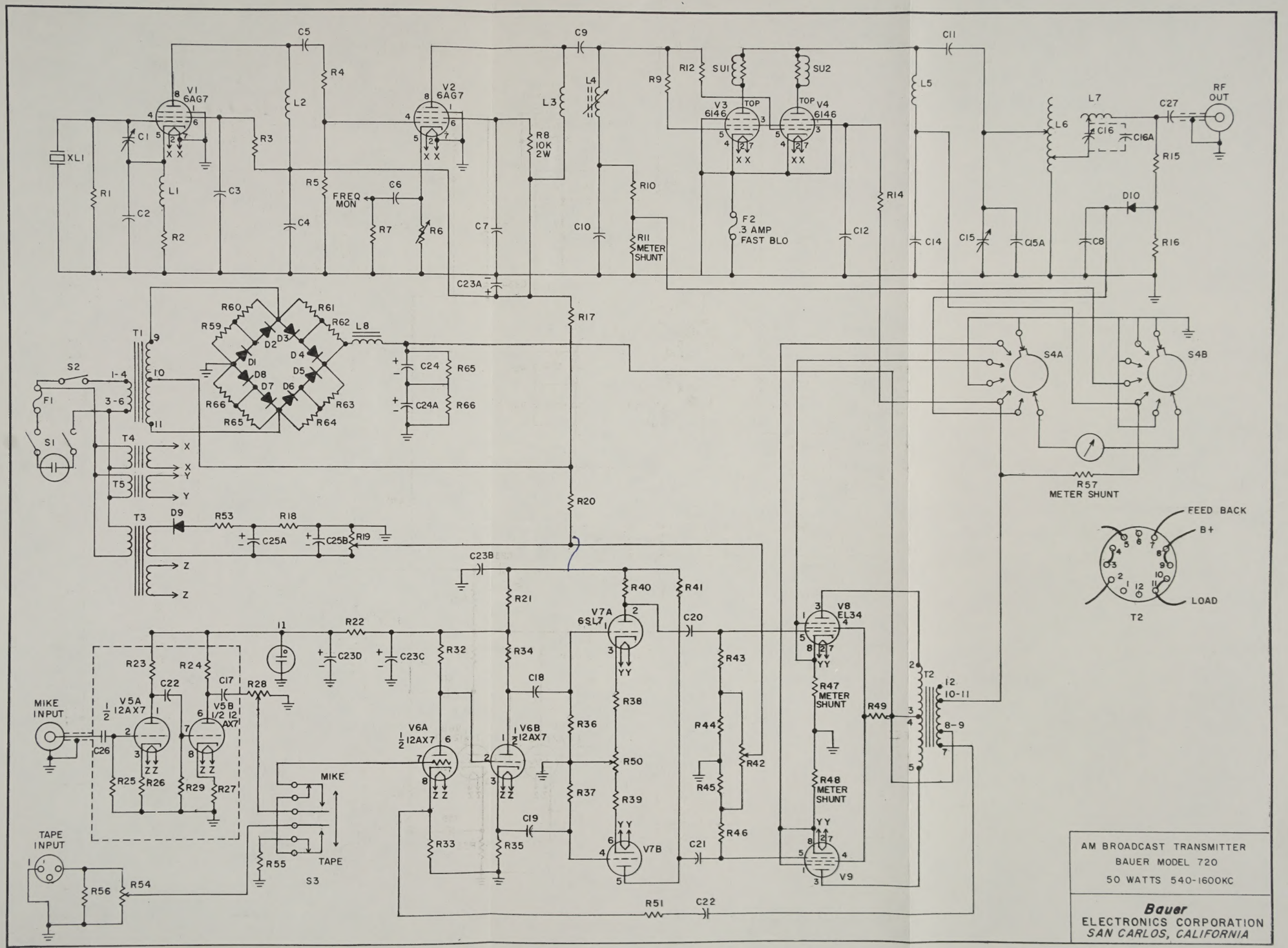
FIGURE 3


C11
L5
L6
L7
C16
C16A
C27
RF OUT
R15
D10
C14
C15
C15A
C8
R16
S4A
S4B
F1
S1
R57
METER SHUNT
FEED BACK
B+
LOAD
T2
MIKE INPUT
TAPE INPUT
12
10-11
8-9
AM BROADCAST TRANSMITTER
BAUER MODEL 720
50 WATTS 540-1600KC
Bauer
ELECTRONICS CORPORATION
SAN CARLOS, CALIFORNIA


AM BROADCAST TRANSMITTER
BAUER MODEL 720
50 WATTS 540-1600KC
Bauer
ELECTRONICS CORPORATION
SAN CARLOS, CALIFORNIA
MIKE INPUT
TAPE INPUT
MIKE
TAPE
FREQ MON
METER SHUNT
FEED BACK
B+
LOAD
T2
S3
S4A
S4B
F2 .3 AMP FAST BLO
V1 6AG7
V2 6AG7
V3 6146
V4 6146
V5A 12AX7
V5B 12AX7
V6A 12AX7
V6B 12AX7
V7A 6SL7
V7B
V8 EL34
V9
RF OUT